Attachment A

Statement of Work

December 1, 2000

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Introduction

This Introduction is intended to highlight selected features of this SOW. It is in no way inclusive and the Contractor is responsible for the entire contents of this contract, which provides for a full range of support across virtually all activities of the Space Science Data Operations Office (SSDOO; http://ssdoo.gsfc.nasa.gov/c630/ssdoo_main.html).

In June 1992, Goddard Space Flight Center (GSFC) established the SSDOO in order to meet the new challenges of introducing cost effective approaches for the acquisition, processing, organization, documentation, archiving, and dissemination of data from many of NASA's space science missions to the world community of scientists and the public. Several recent references with recommendations for continuation or initiation of various new missions are the 1997 Space Physics Senior Review (cf. http://www.hq.nasa.gov/office/oss/strategy/SEC_review/index.htm) and the 1997 OSS Space Science Draft Strategic Plan (cf. http://www.hq.nasa.gov/office/oss/strategy/1997/index.htm).

The SSDOO organization is comprised of the Astrophysics Data Facility (ADF) the Space Physics Data Facility (SPDF), the National Space Science Data Center (NSSDC) and the Orbiting Satellites Project (OSP). The ADF and SPDF pursue activities in support of individual spaceflight projects and support discipline-specific, value-added aspects of the NSSDC. The NSSDC is NASA's long-term archive. OSP is responsible for the project management of GSFC's operating space science missions. The primary categories of SSDOO activities are: the development and operation of mission-specific ground data systems; the archiving and dissemination of public data from most NASA space science missions; and the development and operation of a number of specific, value-added science data systems and services.

NSSDC (http://nssdc.gsfc.nasa.gov) is responsible for the acquisition of data and supporting material (metadata, software, ancillary data, etc., needed to render data manageable at NSSDC and correctly and independently usable by its intended users), and for the preservation, management, and accessibility/dissemination of data bundles (data with accompanying supporting material). Virtually all data being newly acquired are digital, although NSSDC still has much legacy film data. Virtually all data being newly acquired are being made network-accessible to users, and older data are being gradually promoted to such status.

NSSDC pursues a program in data-relevant standards, in collaboration with other NASA science data management entities, and advises new missions in their data planning and eventual archiving. NSSDC also supports comprehensive metadata bases holding information about data at NSSDC and elsewhere and about the missions and experiments from which those data come. As mentioned above, value-added activities are pursued throughout SSDOO, both as part of the NSSDC function and otherwise. Finally, NSSDC operates World Data Center-A for Rockets and Satellites (http://nssdc.gsfc.nasa.gov/about/about_wdc-a.html) with responsibilities for satellite launch announcements; NSSDC receives and responds to data requests from outside the U.S. through WDC-A-R&S.

SPACE SCIENCE DATA SYSTEM: NASA's Office of Space Science is creating a Space Science Data System with a series of distributed nodes, including a permanent archive, intended to deliver the most favorable cost-benefit ratio of service to researchers and other customers of the OSS public-data environment. SSDS will evolve from the present distributed OSS data infrastructure which includes NSSDC as present OSS-chartered provider of OSS permanent archiving and SSDOO more generally as OSS-chartered provider of several other services. It is probable that some SSDOO activities initially covered by the contract will be rechartered via competition or designation by OSS for possible continuation elsewhere in SSDS during the life of this contract. The focus for possible "outplacings" are science-expertise-dependent activities, with science-expertise-resident sites as the likely recipients of outplaced work. SSDS evolution will be guided by an OSS-defined Technical Working Group which includes SSDOO participation. Relevant contract clauses will be invoked if any work is outplaced.

1 Performance Based/Metric Services

Integrated Systems Approach

The contractor shall implement the "Gatekeeper" system into the NSSDC archive pipeline which creates a deep-archive copy of all data immediately upon arrival while insuring providing the appropriate checkpointing for time stamping of data arrival and notifying responsible individuals. The contractor shall change the pipeline processing for NDADS for metadata capture, upgrade FST to reduce complexity and redundancy thereby simplifying cross-referencing queries, automation of system monitoring and trend logging/analysis, and implement a Java based distribution system utilizing loss less compression to reduce media duplication costs wherever possible.

1.1 A Metrics Tracking System

The contractor shall develop a plan for the creation and operation of the metric tracking system. This plan shall be submitted within 45 calendar days of contract start for approval by the Government. The contractor shall design, develop, and maintain a database for the purpose of logging and tracking the performance and metrics of the other performance-based elements of this contract. The Government shall have "read only" access.
Metrics:

M1 Reserved

M2 (100*) Database is maintained current. The Metrics Tracking System web site shall be completely updated to reflect a month of metrics data that are: (Averaged over the evaluation period, monthly checks of the database reveal:)
- No information more than 2 working days** after the end of the month - outstanding
- No information more than 4 working days after the end of the month - passing
- One or more items more than 4 working days after the end of the month - failing

* This is the weight of this metric, within this work activity; it is used in computation of the incentive fee discussed in detail in Attachment G to this RFP.
** A "working day" as used here and subsequently means the interval between a given time point of an event (e.g., 0945 UT) and the same time point on the next work day.

1.2 NSSDC Data Operations

INTRODUCTION - This area consists of three primary groups of activities: the ingestion into NSSDC's nearline systems and offline archives of data newly arriving at NSSDC; the management and preservation of data in the archives; and the satisfying of requests for data primarily via the offline mailing of media. Among other things, the contractor shall ensure that all data transcriptions (rewriting of data to new media on

ingest to NSSDC, on user request, or as part of the ongoing data preservation process) are performed with perfect fidelity (bit pattern in = bit pattern out). This area is generally not responsible for initiating the flow of data from providers to NSSDC, nor for the quality of data bundles delivered to NSSDC. It is responsible for annually specifying its resource needs (e.g., ADP capacity and capability) based on NSSDC's Archive Plan (government developed/maintained with contractor input) which will specify data inflow rates, schedules and modes and will also specify the level of service (e.g., ingest to NDADS) to be accorded each new data set.

THE NSSDC ARCHIVE - NSSDC holds several thousand separately identified data sets from about one thousand instruments that have flown on a few hundred mostly-NASA spacecraft. Most data are in the space science areas (astrophysics, space plasma and solar physics, lunar and planetary science) although NSSDC still holds thousands of tapes holding legacy Earth science data for the ESDIS Project Office at GSFC. Most NSSDC data are digital, mostly held on 9-track tape, 3480 tape cartridges, and CD-ROM. Most data are held in two copies, one at and one away from GSFC. (The extra-GSFC facilities are NARA's Washington National Records Center and the GSFC/500-managed Tape Staging and Storage Facility.) Older data are now being written to Digital Linear Tape (DLT) as NSSDC's media of choice for internal data management for the coming few years. NSSDC's digital archive consists of about 10 TB. Of this, somewhat more than 2 TB are held on NDADS (NASA Data Archive and Distribution System), NSSDC's network-accessible nearline mass storage environment. NDADS consists primarily of a network-attached DEC/VMS computer hosting a pair of Cygnet optical disk jukeboxes, with the addition of a UNIX/DLT component due imminently. Much NSSDC-developed software (for example, FST, SOAR) underlies NDADS, in addition to commercial software including Sybase, JIMS, and Unitree. NSSDC's offline media are tracked with Oracle-based NSSDC-developed software called IDA (Interactive Digital Archive).

1.2.1 The Data Ingest Operations Function

Data arrive at NSSDC from many sources. Some data arrive electronically, and some data arrive on mailed or hand-carried media. Some data sets arrive in their entirety in one delivery, others in sporadic deliveries, and yet others in regular deliveries. When first data of a data set (are about to) arrive, appropriate records are created in NSSDC's information (metadata) bases as the result of interactions between the responsible acquisition scientist and the information systems operations team (see e.g. discussion of data ingest planning in the Acquisition Scientist Handbook, at http://nssdc.gsfc.nasa.gov/~bell/acquisition/). The data ingest team enters meta information into these information databases reflecting the arrival of new data and its ingest stage and availability.

Data arriving on media are transferred to NSSDC-standard media when needed and, if slated for ingest to the online data dissemination environment, are scheduled for such ingest and then so ingested. Data arriving electronically are (typically) written to the online environment as they arrive, and DLT copies of the data are created for the permanent archive.

A special data flow is that of ISTP Key Parameter files and related data which are pushed by the ISTP CDHF or other existing or to be defined data sources to specified staging disks. These files are in CDF and may grow in volume to 30-60 GB or more annually over time. These files are validated, ingested to the online data dissemination environment and pushed to the CDAWeb system disks.

During the nearline or online ingest process, the data ingest team runs the data through whatever data validation and/or transformation and/or other software package has been delivered from elsewhere at SSDOO. The metrics below assume that such software is fully operational as the data arrive, and relate only to data files which pass relevant validation tests as part of the ingest process.

Metrics for data ingest function:

M3 (12)   Data destined for the online data dissemination environment arriving electronically are ingested to the online environment, with all appropriate information databases updated
- At least 98% of the data files within 1 working day of arrival - outstanding
- At least 90% of the data files within 1 working day and at least 98% within 2 working days - passing
- Less than passing performance - failing

M4 (4)   Complete processing of ISTP Key Parameter and related data (validation, ingest to the online data dissemination environment, push to CDAWeb), with all appropriate information databases updated
- At least 98% of the data files within 1 working day of arrival - outstanding
- At least 90% of the data files within 1 working day and at least 98% within 2 working days - passing
- Less than passing performance - failing

M5 (4)   Longest interval (over the evaluation period) between electronic arrival of any file destined for the online data dissemination environment and its complete processing is:
- <2 working days - outstanding
- <5 working days - passing
- >5 working days - failing

M6 (8)   Data destined for the online data dissemination environment arriving on physical media ingested to the online environment within 4 work days of arrival, with all appropriate information databases updated
- At least 98% of the data files - outstanding
- At least 90% of the data files - passing
- Less than 90% of the data files - failing

M7 (12)   Except as noted below, all data (arriving electronically and on physical media) written to permanent archive media (backup) within 4 work days of arrival, with all appropriate information databases updated

- At least 98% of the data files - outstanding
- At least 90% of the data files - passing
- Less than 90% of the data files - failing

Excepted from this last metric are rare cases where the government certifies that no second set of a set of arriving media is needed.

1.2.2 Archive Management

The primary NSSDC responsibility is to ensure that the data bundles (data and accompanying supporting materials) entrusted to it are reliably findable, retrievable, and usable into the indefinite future. The contractor shall manage the archive so as to ensure this. In so doing the contractor shall monitor media for deterioration and migrate data to new then-optimal media at appropriate intervals. The contractor shall maintain accurate records on the location and state of NSSDC-archived data files and media volumes.

The contractor shall develop an Archive Management Plan for the management of the data archive, including monitoring of the media, the replacement of the media and a schedule and the tracking of the data files and media. Management of the data is expected to be at GSFC-provided facilities, but could be proposed for elsewhere if judged data-safe and cost-beneficial. References to media care/handling standards underlying the plan shall be cited (e.g., those of NARA and NBS/NIST). Digital and analog data held at NSSDC at contract inception which are not in conformance to the plan shall be brought into conformance. A supplement to the primarily digital-data plan shall address NSSDC's film archive. In addition to the basic parameters relevant to both digital and film data, the supplement shall address the conversion of a selected subset of film to digital format. Over the duration of the contract, approximately 5% of the current film archive should be planned for conversion each year. The plan shall include the schedule for transition of the initial archive to plan conformance. The plan shall be drafted and government-approved within two months of contract initiation and then implemented. This plan shall be reviewed (annually or more frequently if needed) and updated.

The contractor shall monitor and replenish the stock of off-the-shelf items (e.g., mass-replicated CD-ROMs) such that depletion of such stock never presents the timely satisfying of requests for such items.

The government will make random checks of the archive to ensure conformance with the plan and relative to environmental and security conditions.

Metrics:
M8 (8)   Media monitoring -
- >10% more media than planned are sampled for deterioration - outstanding
- media monitoring plan followed to within 10% - passing
- >10% less media than planned are sampled for deterioration - failing

M9 (12)   Media replacement -
- conform to plan schedule to within 2% - outstanding

- conform to plan schedule to within 10% - passing
- depart from plan schedule by >10% - failing

M10 (12) Transition of initial archive to plan - all data not previously in conformance will be brought into conformance after government acceptance of the plan
- more than 10% faster than called for in plan - outstanding
- within 10% of planned schedule - passing
- more than 10% longer than called for in plan - failing

M11A (4) Environmental Controls shall be maintained:
- Calibrate the temperature and humidity chart semi-annually at six month intervals.
- Insert paper in the recorder as needed and retain the weekly charts for a minimum of two years.
- Inform the Government within 8 working hours when environmental conditions deviate from the following: when the physical plant does not conform to NARA guidelines of a constant temperature of 62-68 degrees Fahrenheit and a constant humitity of 35 percent to 45 percent.

Outstanding requires that the Contractor meet all three of the above items.
Failure means that the Contractor did not meet all three of the above items.

M11B (4) Archive Security shall be maintained:
- Provide "in-person" coverage of the library, as a minimum, from 8:00 AM to 11:00 AM and from 1:00 PM to 3:00 PM each working day, (except in the event of conflicting activities for which the tape librarian and all designated backups are required; e.g., "All Hands" Meetings)
- Secure the library each working day.
- Maintain and execute a written Standard Operating Procedure (SOP) for "sign-out/sign-in" of data from/to the library. The SOP shall be in place by December 15, 1999.
- Manage the status of off-line storage by maintaining an inventory.
- At the end of every 6-month evaluation period, report the number of boxes and media at the Federal Records Center, Iron Mountain, and any other off-site location to the Head, NSSDC.

Outstanding requires that the Contractor meet all five of the above items.
Passing requires that the Contractor meet four of the five above items.
Failure means that the Contractor met less than four of the above items.

Note that data loss is not treated with a "regular" metric but, due to the overriding importance of data preservation, with a special term in the Incentive Award algorithm which yields a 2% decrease in the otherwise available technical award fee (for all other PBC work) for each data file irretrievably lost or corrupted (not to exceed 50%). The Contracting Officer will provide the Contractor with a written exception, for all data that

do not require backup, with effective dates. This exempts the Contractor from the 2% decrease in the otherwise available technical award fee for those data. Data backup Exemption Letters will be incorporated into Attachment E of the contract via unilateral modificaiton to the contract.

1.2.3 Request Services

A fundamental operational function of the NSSDC is to retrieve and disseminate data from the NSSDC archive to scientific and other requesters. These data include both analog (film based) and digital data. While many NSSDC data access paths are fully automated and require no NSSDC staff involvement, this activity is staff-involved. The medium of distribution depends upon the volume and character of the data; in some cases the requester may select among several alternatives. Most offline dissemination today involves mass-replicated CD-ROMs, although a significant photo/print request level and a modest replicable digital media request level continue. The contractor shall: support potential users' understanding of SSDOO data and services; retrieve from offline or nearline areas all requested data granules/data sets and their documentation; disseminate the retrieved data on media with relevant accompanying documentation or, when appropriate, stage to disk for electronic dissemination; link requesters to discipline experts at SSDOO or elsewhere when beneficial to match user needs and SSDOO data assets and to promote users' correct and effective data use; provide support functions including accurate reporting of completed requests, quality assurance of the delivered product, process and systems analysis, and tracking of request status at any point in time; set the customers expectations with stated deadlines and then work to meet those deadlines; bill for services and manage receipts and the receipts tracking system; and perform user satisfaction surveys and modify procedures appropriately. This function also covers support to users of NSSDC systems and interfaces in their understanding and use of those systems and interfaces.

Request Services also includes the promotion of NSSDC services to the user communities at meetings, through networks or other advertising approaches, and by direct contact. The support personnel promote the use of the data by future scientists through participation in NASA education initiatives. A support office, including a CD-ROM browse facility, is maintained so that scientists or educators may visit NSSDC (open during normal business hours) and receive direct information or training in access to or use of NSSDC data. The requirements and evaluation metrics for this activity are:

M12 (5)   CD-ROM (and other off-the-shelf items, such as posters) requests
- >95% of requests mailed out within 2 work days of receipt at NSSDC - outstanding
- >95% of requests mailed out within 5 work days of receipt at NSSDC - passing
- >5% of requests take longer than 5 work days - failing

M13 (3)   Requests for photos and other replicable media

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Elapsed time between request receipt and order mailing (not including time at photo facility outside NSSDC)
- Less than 3 work days for >95% of requests - outstanding
- Less than 7 work days for >95% of requests - passing
- Longer than 7 work days for > 5% - failing

M14 (5)   Accuracy of request services
- No user feedback reporting non-receipt of requested data and supporting material - outstanding
- Less than 1 reports/month (averaged over evaluation period) of non-receipt of requested data and supporting material - passing
- One or more reports/month (averaged over evaluation period) of non-receipt of requested data and supporting material - failing

M15 (7)   User Satisfaction Level
- >98% of users are satisfied with user request services (as measured by government-approved contractor-administered user satisfaction survey; not including dissatisfaction with NSSDC data holdings) - outstanding
- >90% satisfied - passing
- <90% satisfied - failing

1.3 Information Systems Operations

NSSDC also provides a comprehensive information functionality related to availability of data both at and away from NSSDC, and to all launched spacecraft and to a great many spaceborne experiments. In addition, NSSDC issues periodic documents (e.g., NSSDC Newsletter, SPACEWARN Bulletin) to communicate information. The intended users of these information bases and documents are the space science research community, NASA program managers, and the general public. The contractor shall perform: periodic requirements reviews; integrations of newly developed software; information capture into NSSDC; operations (information insertion, information system management, report generation, etc.); editorial and layout support of the NSSDC documents and interactions with the GSFC printing and mailing infrastructures.

Most users access the organization's information systems environment through the World Wide Web pages. A number of interrelated information systems are available through these pages. For example, the NASA Master Catalog provides access to high-level information about NSSDC-held data sets and their sources. Other information systems contain information about the bibliographic references further describing the data, contact information for individuals knowledgeable about the data, data requests, and the media holding the data at NSSDC. These information systems which have a long history at NSSDC include: Relational System for Information Retrieval and Storage (RSIRS), Interactive Request Activity and Name Directory (IRAND), Automated Internal Management (AIM) File, Personnel Information Management system (PIMS), Interactive Data

Archive (IDA), Technical Reference File (TRF), and NSSDC Supplemental Data File (NSDF). [Some of this nomenclature is presently changing as the data bases are evolving.] The AIM file is used for a number of reports (ie: SATX report, TRF report, AIM File Index report). These reports are internal documents used by the staff in responding to a variety of requests and need to be regenerated periodically. These reports should provide an accurate reflection of what are the data holdings of the NSSDC.

The evaluation metrics for this activity are:

M16 (15)   Populate appropriate databases with acquired information
o   Within an average of one working day of receipt -outstanding
o   Within an average of less than five working days of receipt- passing
o   Greater than an average of five working days after receipt- failing

M17 (20)   All information databases are accessible and fully usable (assuming system availability)
o   More than 99% of the time - outstanding
o   97-99% of the time - passing
o   Less than 97% of the time - failing

M18 (15)   Database and information system related complaints are logged and the date of resolution of the problem is tracked. Problem is fixed:
o   Within an average of one working day of receipt - outstanding
o   Within an average of less than five working days of receipt - passing
o   Greater than an average of five working days after receipt - failing

Metrics M19 A - C are evaluated based on compliance with a SOP. The Contractor shall submit the draft SOP for Government approval by January 3,
2000. Metrics M19 A - C shall become effective upon Government approval of the SOP.

M19A (5)   FILEX Reports shall be prepared according to the SOP.
o   Preparation and dissemination by February 1st and August 1st - outstanding
o   Preparation and dissemination no more than 5 working days late - passing
o   Preparation and dissemination more than 5 working days late - failing

M19B (5)   SATX Reports shall be prepared according to the SOP.
o   Preparation and dissemination by May 1st and November 1st - outstanding
o   Preparation and dissemination no more than 5 working days late - passing
o   Preparation and dissemination more than 5 working days late - failing

M19C (10)   SPACEWARN Bulletins shall be prepared according to the SOP.
o   Delivery by the first working day of the month - outstanding
o   Delivery no more than 5 working days late - passing
o   Delivery more than 5 working days late - failing

Metric M19D (30) relates to the preparation of the NSSDC Newsletter specifically. The contractor shall be evaluated based on the duration elapsed between the time the contractor has in hand all material (articles and abstracts) needed for the newsletter and the delivery to the GSFC print shop:

o   Less than 2 weeks - outstanding
o   Between 2 and 3 weeks - passing
o   Longer than 3 weeks - failing

1.4 Computing System Operations

The SSDOO uses a number of operational computer systems running a variety of operating systems (VMS, UNIX, Mac OS, Microsoft Windows) and networks (DECnet, TCP/IP, AppleTalk) on Ethernet and FDDI. The NSSDC Data Archive and Distribution Service (NDADS) system is a subset of these computer systems that provide the capabilities for NSSDC to collect, manage in a nearline mode, and electronically distribute a large fraction of the space science data archive. NDADS includes a set of nearline optical disks and Digital Linear Tapes (DLTs), a large online archive, and rapid distribution services, based primarily on a VMS computing cluster in Building 28 at GSFC. Schedule A lists the computer systems and software currently covered under this section.

The high-level configuration and acquisition of hardware and software for NDADS will be determined by a Configuration Control Board (CCB) staffed with both Government and Contractor personnel and chaired by the Government. Changes will be proposed to the Board and agreed to before implementation. Problems will also be addressed to the CCB and are expected to fall into three categories: 1) those easily resolved by the contractor, 2) those requiring external support or correction, and 3) intractable or resource-intensive problems.

The contractor shall provide hardware and software installations, hardware and software maintenance and updates, load balancing, performance optimization, resource management, and other systems and local network management. Configuration management shall be provided and configuration lists of hardware and software will be kept accurate, up-to-date, and available to the Government at all times. Complete backups of these computer systems shall always be maintained. While operations are automated as much as possible, computer operators shall be provided to load and manipulate computer media in a normal computer room environment.

Computer systems operate all the time (24 hours, 7 days a week: 24x7) but are staffed only during the prime shift with problem support on evenings and weekends (see After Hours Support in the bidders library). Downtime for maintenance, testing and upgrades shall be scheduled, approved by the CCB, and announced in advance when possible, taking into account demonstrations and other special events; this scheduled downtime will not count against system uptime and availability.

A system is considered available when the entire hardware and software configuration operates correctly and is defined as unavailable when the contractor discovers a problem (a portion of the system or the entire system not operating correctly which impacts the system's ultimate functions) or is otherwise notified of a problem (for example, with a trouble ticket) until returned to full operation. Relative importance of the computer

systems and peripheral components is shown in Schedule A. The formula defining entire system availability is also provided in Schedule A. Note that if a computer is down, all of its peripheral components are also considered to be down. Further if a systems software fails, i.e., the operating system is inoperative, the entire computer system and its peripheral components are considered to be down. If the inoperative software component is self contained the computer system only is considered to be the failed component. The evaluation metrics for this activity are:

M20 (60)   Maximize availability of the systems and related key components identified in Schedule A
- Availability of at least 99% - outstanding
- Availability of at least 98% - passing
- Availability of less than 98% - failing

M21 (15)   Systems shall be maintained such that incidents of computer break-ins, viruses, worms, Trojan horses, hacker intrusions, and other security breaches are minimized. Operating systems, security packages, and other software shall be kept up-to-date. Security procedures shall follow NASIRC guidelines and the SSDOO Security Policy. Major incidents (damage to systems or NASA's reputation, financial loss, denial of service, unauthorized deletion, modification or disclosure of information) shall be handled in coordination with NASIRC and the Office of the Inspector General. Substantial changes to the security systems shall be approved by the CCB. Number of major incidents during evaluation period are:
- 0 - outstanding
- 1 - passing
- More than 1 - failing

M22 (25)   Changes and installations of system-level software, major packages, and major hardware shall be approved by the CCB. The vendor shall respond to the CCB in one work day either with a implementation schedule submitted for approval or a request for reconsideration based on technical difficulties or risks to project operations. Once a schedule is approved, the changes will be implemented:
- Ahead of the schedule by at least 1 working day - outstanding
- By close of business of day on the schedule - passing
- One or more working days behind the schedule - failing

1.5 ROSAT Science Data Processing and Management

Routine satellite science data processing for several high energy astrophysics missions is required. For the Roentgen Satellite (ROSAT; http://adfwww.gsfc.nasa.gov/rosat/rosatSDC.html) mission, the Astrophysics Data Facility is responsible for the U.S. ROSAT Science Data Center (USRSDC). The USRSDC obtains raw telemetry data from Max Planck Institute (MPI), time aligns and calibrates low level data, and creates higher level data products. The function of the USRSDC is to

provide these science data products and services to the astrophysics community. ROSAT data products and intermediate data files shall be generated and distributed appropriately to Guest Observers, the NSSDC archive, and the High Energy Astrophysics Science Archive Research Center (HEASARC).

A) The Contractor shall operate the ROSAT science data processing system. The Contractor shall install ROSAT software/calibration upgrades provided by MPI, within $X1=11$ work days of release, and test the software/calibration for use in ROSAT standard data processing within an additional $X2=11$ work days. The Contractor shall report any problems found within $Y=2$ work days to the ROSAT GOF/MPI/SAO, and implement the software/calibration release as part of the ROSAT standard data processing within $Z=6$ work days of the correct functioning of the software/calibration release as determined by the ROSAT GOF.

M23 (10) • maximum of all X1, X2 less than or equal to 10 work days - outstanding
- maximum of all X1, X2 equal to 11 work days - passing
- maximum of all X1, X2 greater than 11 work days - failing

M24 (2) • maximum of all Y less than or equal to 1 work days - outstanding
- maximum of all Y equal to 2 work days - passing
- maximum of all Y greater than 2 work days - failing

M25 (5) • maximum of all Z less than or equal to 5 work days - outstanding
- maximum of all Z equal to 6 work days - passing
- maximum of all Z greater than 6 work days - failing

B) This metric is intended to test the installation and routine operation of the data processing pipeline. It is essential that the data processing pipeline generate valid products at all times. When any change is made to the pipeline or to the computing environment in which the data processing occurs, the contractor shall follow the test plan (see section 2.1) and demonstrate that the pipeline products are entirely consistent with expected results.

M26 (25) Pipeline Testing/Validation
- Producing data according to test plan after first installation attempt - outstanding
- Producing data according to test plan after second installation attempt - passing
- Not producing data according to test plan within 2 installation attempts - failing

C) ROSAT data products and intermediate data files shall be provided to members of the USRSDC within $X=2$ work days of the request. Trend data and other data files as specified by the Project Scientist shall be distributed to the USRSDC members within $Y=2$ work days of their production. This includes data that will be used by the ROSAT Results Archive.

M27 (5) • average of X is less than or equal to 1 work days - outstanding

- average of X is equal to 2 work days - passing
- average of X is greater than 2 work days - failing

M28 (2)   • average of Y is less than or equal to 1 work days - outstanding
- average of Y is equal to 2 work days - passing
- average of Y is greater than 2 work days - failing

M29 (1) The Contractor shall respond to phone, email, or physical communications from outside individuals within Y=1 work day of their receipt. If the request can not be completed within this period, a suitable reply expressing how long the answer will take shall be provided within the period.
- average of Y less than 1 work days - outstanding
- average of Y equal to 1 work days - passing
- average of Y greater than 1 work days - failing

M30 (30) The Contractor shall ensure that high quality ROSAT data products are generated and delivered in a timely fashion to Guest Observers and the High Energy Astrophysics Science Archive Research Center (HEASARC). High quality data products are produced by processing data by the latest correct processing system with all appropriate calibrations applied. The Contractor shall provide the results of ROSAT standard data processing to the ROSAT Guest Observers (those who receive US processing as determined by the ROSAT Project Scientist) for X=80% of new observations within 15 work days of receipt of the ROSAT raw telemetry from MPI as averaged over a period of 3 months. The media they are provided on should be of the form (on magnetic disk for ftp/network transfer or in the mail for physical media) desired by the Guest Observer but the contractor is not required to supply any media form that is not one of the standard ROSAT media.
- X greater than or equal to 90% - outstanding
- X greater than or equal to 80% - passing
- X less than 80% - failing

M31 (5)   The Contractor shall supply ROSAT standard data processing results to the ROSAT GOF/HEASARC in the requested form (i.e. network or CD) for X=80% of all new observations received from MPI within 20 work days of receipt of the ROSAT raw telemetry from MPI, as averaged over 3 months. This metric is acceptably met (passing) if the ROSAT GOF/HEASARC can not receive the data at the time it is ready for delivery. In this case, the contractor shall save the data for later transfer to the ROSAT GOF/HEASARC. Transfer of this saved data shall begin within 2 work days of the ROSAT GOF/HEASARC notifying the Contractor it is ready to receive the data and proceed at a rate no less than 1/2 the average transfer rate for data sent to the ROSAT GOF/HEASARC.
- X greater than or equal to 90% - outstanding
- X greater than or equal to 80% - passing
- X less than 80% - failing

M32 (15)   The Contractor shall reprocess previously processed ROSAT data every time the ROSAT calibration and other software algorithms change. The results of the reprocessing shall be supplied to the ROSAT GOF in accordance with the metrics of section 1.5. The rate of reprocessing shall be such that X=80% of all existing ROSAT data have been reprocessed within one year of the declaration by the ROSAT Project Scientist.
- X greater than or equal to 90% - outstanding
- X greater than or equal to 80% - passing
- X less than 80% - failing

1.6 ASCA Science Data Processing and Management

In a manner similar to ROSAT, the ADF also performs routine science data processing and distribution for the Advanced Satellite for Cosmology and Astrophysics (ASCA; http://adfwww.gsfc.nasa.gov/asca/ascaDF.html). ASCA is a Japanese spacecraft that contains NASA instruments and was launched in February 1993. ASCA data products and intermediate data files shall be generated and distributed appropriately to Guest Observers, the NSSDC public archive, and the High Energy Astrophysics Science Archive Research Center or HEASARC.

A) The Contractor shall operate the ASCA science data processing system. The Contractor shall install ASCA software/calibration upgrades provided by the ASCA GOF, within $X1=11$ work days of release, test the software/calibration for use in ASCA standard data processing within an additional $X2=11$ work days, report any problems found within $Y=2$ work days to the ASCA GOF, and implement the software/ calibration release as part of the ASCA standard data processing within $Z=6$ work days of the correct functioning of the ASCA GOF software/calibration release.

M33 (15)
- maximum of all X1, X2 less than or equal to 10 work days - outstanding
- maximum of all X1, X2 equal to 11 work days - passing
- maximum of all X1, X2 greater than 11 work days - failing

M34 (2)
- maximum of all Y less than or equal to 1 work days - outstanding
- maximum of all Y equal to 2 work days - passing
- maximum of all Y greater than 2 work days - failing

M35 (5)
- maximum of all Z less than or equal to 5 work days - outstanding
- maximum of all Z equal to 6 work days - passing
- maximum of all Z greater than 6 work days - failing

B) This metric is intended to test the installation and routine operation of the data processing pipeline. It is essential that the data processing pipeline generate valid products at all times. When any change is made to the pipeline, or the computing environment in

which the data processing occurs, the contractor shall follow the test plan (see section 2.2) and demonstrate that the pipeline products are entirely consistent with expected results.

M36 (25) Pipeline Testing/Validation
- Producing data according to test plan after first installation attempt - outstanding
- Producing data according to test plan after second installation attempt - passing
- Not producing data according to test plan within 2 installation attempts - failing

C) ASCA data products are distributed to the ASCA Guest Observers, the HEASARC, and to the NSSDC.

M37 (3)   The Contractor shall respond to phone, email, or physical communications from outside individuals within $Y=1$ work day of their receipt. If the request can not be completed within this period, a suitable reply expressing how long the answer will take shall be provided within the period.
- average of Y less than 1 work days - outstanding
- average of Y equal to 1 work days - passing
- average of Y greater than 1 work days - failing

M38 (30)   The Contractor shall ensure that high quality ASCA data products are generated and delivered in a timely fashion to Guest Observers and the High Energy Astrophysics Science Archive Research Center (HEASARC). High quality data products are produced by processing data by the latest correct processing system with all appropriate calibrations applied. The Contractor shall provide the results of ASCA standard data processing to the ASCA Guest Observers (those who receive US processing as determined by the ASCA Project Scientist) for $X=80\%$ of new observations within 15 work days of receipt of the ASCA raw telemetry from ISAS as averaged over a period of 3 months. The media they are provided on should be of the form (on magnetic disk for ftp/network transfer or in the mail for physical media) desired by the Guest Observer but the contractor is not required to supply any media form that is not one of the standard ASCA media.
- X greater than or equal to 90%   outstanding
- X greater than or equal to 80%   pass
- X less than 80%   fail

M39 (5)   Contractor shall supply ASCA standard data processing results to the ASCA GOF/HEASARC in the requested form (i.e. network or CD) for $X=80\%$ of all new observations received from ISAS within 16 work days of receipt of the ASCA raw telemetry from ISAS as averaged over a 3 month interval. This metric is acceptably met (passing) if the ASCA GOF/HEASARC can not receive the data at the time it is ready for delivery. In this case, the contractor shall save the data for later transfer to the ASCA GOF/HEASARC. Transfer of this saved data shall begin within 2 work days of the ASCA GOF/HEASARC notifying the Contractor it is ready to receive the data and proceed at a rate no less than

1/2 the average transfer rate for data sent to the ASCA GOF/HEASARC. In no case shall untransferred data exist at the end of the contract.
- X greater than or equal to 90%   outstanding
- X greater than or equal to 80%   pass
- X less than 80%   fail

M40 (15) The Contractor shall reprocess previously processed ASCA data every time the ASCA calibration and other software algorithms change. The results of the reprocessing shall be supplied to the ASCA GOF under metric M39. The rate of reprocessing shall be such that X=80% of all existing ASCA data have been reprocessed within one year of the declaration by the ASCA Project Scientist.
- X greater than or equal to 90%   outstanding
- X greater than or equal to 80%   pass
- X less than 80%   fail

1.7 Electronic Handbooks

Electronic handbooks (http://lincoln.gsfc.nasa.gov/ehbs.html) are being developed and implemented to manage complex distributed organizational processes without the use of paper or programming efforts. These tools use World Wide Web interfaces and underlying databases and other capabilities, such as graphic tools, to enable interactive management of various processes through computer networks. Examples of the types of processes to which this has been applied are: education evaluation, network security reporting, etc. Examples of some HQ organizations that are currently using the tools are: Small Business Innovation Research (SBIR) Program (Code RC), Education (Code FE), Minority Universities Research and Education Division (MURED) (Code EU), Agency Directives (Code J), etc. "Handbooks" are comprised of "chapters" which are comprised of "sections" and "user handbooks" both of which are comprised of "steps". The contractor shall work with the process owners to develop approximately 10 4-chapter handbooks annually.

After the government determines the "intellectual content" necessary to create an electronic handbook, a "work order" for the handbook will be created and issued to the contractor, comprised of chapter, user handbooks, and steps specifications. Based upon this, a delivery date will be negotiated between the government and the contractor.

M41 (50)   Metric: For at least 90% of the chapters delivered during the evaluation period -
- delivery is made before 3/4 of the scheduled time elapses - outstanding
- delivery is made on the scheduled delivery date - passing
- non-passing performance – failing

M42 (25) The Contractor shall maximize availability of the EHB systems
- EHB systems are available at least 99 percent of the time – outstanding
- EHB systems are available 98 – 99 percent of the time – passing

- EHB systems are available less than 98 percent of the time – failing

M43 (25) The Contractor shall ensure on time delivery of requested EDCATS modifications. For each request, determine a score depending on when it was delivered with respect to the due date. Final metric is the average of scores for each modification.
- All Modifications delivered on time – outstanding
- Average of all Modifications delivered less than two days late – passing
- Average of all Modifications delivered more than two days late - failing

1.8 Data Systems Development

NSSDC manages a great deal of data, offline in deep archives and as inventories of CD-ROMS, nearline as data files on NDADS, and online both as FTP-accessible files and as files subsettable by time and parameter in systems such as CDAWeb and OMNIWeb. To support these, NSSDC government staff defines evolving data volume, access, and performance requirements. Applications systems must be defined, developed, made operational, and evolved in order to meet these requirements, and those requirements in the NSSDC Evolution Plan.

Current examples of data management software include the NDADS-relevant SOAR, ARMS, and FST software, and other software utilities. The contractor shall support the process of defining evolving requirements, and shall play key roles in defining, developing, and evolving software systems for satisfying the requirements. The contractor shall assist in the defining of an optimally integrative system and interface providing management of and user access to the multiplicity of NSSDC-managed offline and network-accessible data and other information services.

Space Sciences Data Operations Office (SSDOO) Configuration Control Board (CCB) Action Requests (ARs) are generated for work related to PBC activities, as well as for some of the work related to the General Computing Environment (GCE) activities.

The general activities under this data systems development work element include, but are not limited to:

1. Perform a requirements analysis and prepare a requirements definition that supports the evolution of NSSDC system architectures and capabilities to meet increasing customer demand. Requirements analysis should focus on both internal system needs driven by evolving technologies and data volumes and external interface needs driven by customer requirements.

2. Prepare an integrated system architecture that encompasses all NSSDC systems and requirements and provides flexibility to allow NSSDC expansion and

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evolution as needs change and grow. The NSSDC system architecture should include separate designs for resource utilization, network architecture, application software architecture (including COTS software), and information architecture.

3. In response to CCB ARs, prepare an implementation plan, with incremental releases, that satisfies the requirements definition and implements the system architecture designs.

4. Develop an integrated data model for NSSDC data and metadata in conjunction with the Information Systems activities.

5. Prepare a configuration management procedures applicable to the Action Request and in accordance with the SSDOO Configuration Management Plan and implement configuration management for all system components.

6. Develop NSSDC subsystems and application software according to the requirements definition; within the framework of the system architecture, the implementation plan, and the integrated data model; and in accordance with the CCB AR process.

7. Provide system engineering for all system components.

8. Update requirements definition and system architecture as needed and modify the data model, system configuration, subsystems, and application software accordingly.

The ARs related to PBC activities are covered by the metric below. This metric will be weighted by the importance of the work and by the scheduled work days, as defined in Attachment G, Appendix 1. When ARs are accepted by the CCB, they will be issued by the Chairman of the CCB, and assigned for analysis and for implementation.

Metric for data systems development:

M44 (100)   For the CCB ARs related to PBC activities, perform the assigned subtask (or entire task if of short duration) according to the following metric. Subtasks typically include (1) the analysis, implementation plan and list of affected CIs; (2) engineering requirements development; (3) design review; (4) test readiness review; and (5) acceptance review and final delivery. All deliveries will be in accordance with the CCB AR process.
   • Delivery is made before 95% of the scheduled work days elapse - outstanding
   • Delivery is made by close of business on the due date, or after 95% but before 105% of the scheduled work days elapse - passing

- Delivery is made after the due date by more than more than 5% of the scheduled work days - failing

2 Astrophysics Activities

The Astrophysics Data Facility (ADF) provides astrophysics data management expertise, and provides data processing, distribution, and other data management support to current and future astrophysics missions. Such missions are returning data sets of increasingly large volume and information content. The processing, archiving, distribution, and analysis of multi-mission astrophysics data sets present major challenges to computational and data management systems. The functions of the ADF include mission data system planning support, data acquisition, data processing, guest investigator support, development of data access and visualization tools, and studies of new information technology utilization.

The ADF works closely with the Code 600 laboratories and flight project personnel outside of Goddard on science data operations activities. It interfaces with the Laboratory for High Energy Astrophysics (Code 660) and the Laboratory for Astronomy and Solar Physics (Code 680). Operationally, the ADF is responsible for supporting the processing and distribution of ROSAT, ASCA, and RXTE science instrument data in conjunction with Code 660.

The ADF participates in data system planning and develops user support tools that serve the needs of scientists. The ADF processes Level-0 data to generate Level-1 data products for international astrophysics missions in which NASA is a partner. The ADF designs, develops, tests, and integrates the state-of-the-art capabilities and systems needed to carry out its mission. The ADF interacts with many data producers to identify and coordinate the acquisition and archiving of appropriate astrophysics data from planned, active and past missions. It also interacts with individual researchers to identify and acquire data sets relevant to future NASA mission planning and operation.

The work on the following elements requires collaboration between NASA personnel and the contractor. In addition, collaboration with researchers at other Government agencies, or at universities, is essential for the successful completion of these elements. This is especially true of Research and Technology Development elements, such as the AMASE Object-Oriented Database.

2.1 ROSAT Data System Development and Validation

The ADF performs a variety of science data processing and data system development functions for the Roentgen Satellite (ROSAT) mission; it operates the U.S. ROSAT Science Data Center (USRSDC). The function of the USRSDC is to provide science data to ROSAT Guest Investigators. More information about the USRSDC can be found at http://adfwww.gsfc.nasa.gov/rosat/rosatSDC.html. The ADF and the Max-Planck Institut in Germany developed over 300,000 lines of code for processing the ROSAT telemetry (TM) data. In addition to the routine processing (as discussed in Section 1.5 above), the contractor shall:

1. Generate the pipeline processing test plan (to be approved by the Project Scientist) which will be used to perform quality assurance, and determine the validity of the data products;
2. Ensure that the ROSAT data are documented for archival use;
3. Generate and distribute trend data and other data files as specified by the Project Scientist.
4. Upgrade and maintain the entire ROSAT data processing system, including the development and operation of the data storage system holding the raw, intermediate, and final data products; and
5. Ensure that proprietary data are protected from public access.

2.2 ASCA Data System Development and Validation

The ADF performs a variety of science data processing and data system development functions for the ASCA mission. The major responsibility for ASCA is to provide science data to the astrophysics community. The ADF has developed over several hundred thousand lines of code for processing the ASCA telemetry (TM) data, which comes from ISAS in Japan. For more information about the ASCA Data Facility, see http://adfwww.gsfc.nasa.gov/asca/ascaDF.html. In addition to the routine processing (as discussed in Section 1.6 above), the contractor shall:
6. Generate the pipeline processing test plan (to be approved by the Project Scientist) which will be used to perform quality assurance, and determine the validity of the data products;
7. Ensure that the ASCA data are appropriately documented for archival use;
8. Generate and distribute trend data and other data files as specified by the Project Scientist;
9. Ensure that proprietary data are protected from public access; and
10. Maintain and enhance (as required by the Project Scientist) the ASCA science data processing system and its public access modes (World Wide Web access pages and PGP encrypted proprietary archive).

2.3 RXTE Systems Development and Processing

The ADF also performs routine science data processing and distribution for the Rossi X-ray Timing Explorer (RXTE) mission. Activities of the RXTE Science Data Center include the ingest and processing of Level-0 RXTE data and timely distribution of the data to the RXTE Guest Observers, RXTE instrument teams, the NSSDC, and the HEASARC. More information about the RXTE Science Data Center is available at http://adfwww.gsfc.nasa.gov/xte/xteSDC.html. The contractor shall:
11. Maintain RXTE Science Data Center systems in a manner that meets RXTE mission data processing and distribution requirements;
12. Operate the RXTE data system;

13. Distribute RXTE data sets in a timely manner;
14. Distribute RXTE data sets to NSSDC for permanent archiving and to the HEASARC for public access; and
15. Ensure that proprietary data are protected from public access.

2.4 Other Mission Support Services

The ADF will be developing and operating science data processing and distribution systems for additional NASA astrophysics missions and projects. An example is the Two Micron All-Sky Survey (2MASS) data distribution system. The contractor shall perform work necessary to complete processing, ingest, archiving, management, and dissemination of such additional data. Also, in selected cases the ADF provides expert scientific support to Guest Investigators. Specific activities include:

16. Determine and implement methods designed to lower the cost of development and operation of future astrophysics mission data processing and data delivery systems;
17. Develop and apply interfaces and techniques that facilitate the archiving of astrophysics data, information, software, and documents;
18. Develop new science data processing systems as required;
19. Ensure protection of proprietary data;
20. Provide expert scientific support to COBE Guest Investigators; and
21. Develop a browsing and data distribution system for the 14 terabyte 2MASS Image Atlas.

The HEASARC supports multi-mission X-ray and gamma-ray archival research. NSSDC is responsible for the deep archive backup of the HEASARC holdings (see the NSSDC-HEASARC MOU). The contractor shall:

22. Support the archiving of all HEASARC holdings; and
23. Transfer any HEASARC-requested high energy astrophysics data currently held at the NSSDC but not the HEASARC to the HEASARC for restoration and archiving.

2.5 Future Mission Planning

The Project Data Management Plan (PDMP) is a document which comprehensively addresses the flow of mission data from the spacecraft to the archive. It also specifies the types, formats, quality, and standards of data products and the associated software and documentation that will be made available to guest investigators. The PDMP of a mission is a "living" document that is first developed during the early mission definition phase. In this area, the contractor shall:

24. Collaborate with selected prospective data providers to support the development and execution of a PDMP;
25. Review with the Government the project plans for mission operations, noting where MO&DA costs could be saved; and
26. Maintain a complete file containing current PDMPs for NASA's astrophysics missions and projects.

In addition, the ADF is involved in the planning of future astrophysics mission data systems, such as ASTRO-E, MAP, and 2MASS. The contractor shall:

27. Participate in planning for future SSDOO science data operations responsibilities, such as those pertaining to ASTRO-E, MAP, and 2MASS.

2.6 Archival Data Quality Assessment Astrophysics

NSSDC is responsible for providing useful data and information to the scientific user community on a long-term basis. The contractor shall:

28. Perform quality assessments of the NSSDC astrophysics archive, and determine ways to improve the archive quality;
29. Perform quality assurance of selected ADF-processed data that are to be delivered to the archive;
30. Develop methods designed to facilitate data product quality assurance and work with remote data providers to implement such methods;
31. Perform appropriate quality assurance of new data products to be archived prior to ingest into the archive; and
32. Perform selected archival assessment, and continually improve the archive documentation, accessibility, and software applications.

2.7 Multispectral Astrophysics Metadata Interfaces

Access to information from multispectral astronomical catalogs, metadata, and ultimately access to data holdings are needed by researchers, mission planners, and the public. The ADF is responsible for providing a variety of network-based interfaces to such information and data, including the Astronomical Data Center's (ADC's) holdings of multispectral astronomical catalogs, mission logs, and astrophysics data holdings; the ADF provides tools that allow sorting, editing, downloading, and simple analysis and display of tabular data. The ADF develops user interfaces to astrophysics data held both at the NSSDC and remotely. The latest software and information technologies, including PERL, JAVA, and cgi, are used.

The contractor shall:

33. Develop WWW-based tools to access, sort, edit, and download metadata holdings;
34. Develop WWW-based tools to deliver such edited tables to Goddard data centers and other data centers for automated queries of their data bases;
35. Develop WWW-based tools to perform statistical and correlative analyses of tabular data;
36. Develop WWW-based tools to allow data displays and visualizations, such as spatial distributions, time coverages, etc.;
37. Participate in the development of interfaces to archived COBE and complementary data, and models of the infrared sky; and

38. Cooperate and collaborate in these developments, as appropriate, with other science data and archive centers.

2.8 Astrophysics Multi-Spectral Archive Search Engine (AMASE) OODB Development Support

The ADF develops systems using the latest innovations in database, network communications, user interface, and data visualization technology to help researchers locate multi-mission astrophysics data, both in the public archives and in the mission data systems. The AMASE prototype is available on the Web at http://amase.gsfc.nasa.gov/. The contractor shall support the further development of AMASE as follows:

39. Provide astronomical expertise to support the derivation of user requirements;
40. Develop and implement system functional requirements;
41. Provide computer database management and system administration for both object-oriented and relational databases;
42. Support the development of user interfaces, including World Wide Web tools, expert system utilities, and data visualization modules;
43. Prepare demonstrations of system capabilities for American Astronomical Society (AAS) and NASA Information System conferences; and
44. Maintain the public version of the prototype system.

2.9 Astronomical Data Center

The Astronomical Data Center (ADC) is the highly regarded U.S. node in a system of worldwide astronomical data centers. The ADC Web site is http://adc.gsfc.nasa.gov/. The ADC is a long-term archive and distribution center for important astronomical catalogs. The contractor shall ensure that the ADC continues to acquire a wide variety of the most useful astronomical catalogs, and make these catalogs available in electronic form to the research community in a timely fashion. In this area, the contractor shall:

45. Collaborate with the Centre de Données Astronomiques de Strasbourg (CDS) and other astronomical data centers to ingest, document, archive, and disseminate astronomical catalogs;
46. Develop and maintain a World Wide Web interface to the ADC catalogs that enables expeditious location and delivery of the relevant data to the research community, provides data browsing capabilities, and links to other Web pages;
47. Develop and follow data and documentation submission guidelines, and validate the incoming catalogs and documentation;
48. Provide the expertise required to improve the existing documentation to a consistent level;
49. Report monthly statistics on the number of new catalogs acquired and the number of catalog requests;
50. Provide ADC user support services;

51. Seek ways to expedite discovery of relevant data, including interactions with the American Astronomical Society (AAS) and the editors of astronomical journals;
52. Produce CD-ROMs containing Selected Astronomical Catalogs;
53. Prepare and distribute the ADC Electronic Newsletter, approximately quarterly;
54. Demonstrate ADC services at scientific meetings;
55. Implement techniques designed to automate archiving of ADC catalogs and extraction of data from the catalogs;
56. Participate in the development of new value-added data products such as the Gezari, et al., Catalog of Observations; and
57. Provide logistical support during meetings of the ADF Science Steering Committee.

2.10 Astrophysics Data Formats

FITS (Flexible Information Transport System) is the standard data format adopted by the international astronomical community, and by NASA for its astrophysics data products. The ADF provides logistical support for the various FITS committees, documents and disseminates information about the FITS standard, and supports users of the standard, especially NASA data providers. The ADF operates a FITS Support Office which maintains a Web site at http://www.gsfc.nasa.gov/astro/fits/fits_home.html.
The contractor shall:

58. Participate in the development of FITS through support of and participation in the International Astronomical Union (IAU) FITS committee, the NOST (NASA/Science Office of Standards and Technologies; see below) FITS technical panel, the AAS Working Group on Astronomical Software, the various discipline and mission working groups, and the FITSBITS exploder and related Web forums;
59. Support the NOST in the formal issuance and updates of FITS standard documents;
60. Promote, document, and support the use of the FITS standard through maintenance of WWW pages containing FITS documents, a help desk, and periodic summaries of the state of FITS, FITS discussions, and links to other FITS sites worldwide;
61. Promote FITS and the FITS Support Office through displays/presentations at astronomical society meetings;
62. Provide a regularly updated list of NASA astrophysics missions and the FITS formats used in their data products;
63. Maintain a listing (with definitions) of all FITS keywords, particularly those used in NASA's astrophysics data products;
64. Develop/adapt browsing and validation software for FITS files for use by developers and general users. This software shall be capable of execution in a variety of computing environments and shall be accompanied by a full suite of test files;
65. Provide a regularly updated listing of all general astronomy and other software packages (e.g., AIPS, IRAF, IDL, etc.) and how they handle the various FITS standard and proposed formats.
66. Provide other services to the FITS user community as may be requested by the various FITS working groups.

3 Space Physics Activities

The Space Physics Data Facility (SPDF) develops and operates a range of programs serving data needs of the NASA and international space physics sciences communities (cf. the SSDOO Overview and http://spdf.gsfc.nasa.gov/). Among SPDF's areas of interest are:

- Data reduction and analysis for specific instruments and empirical, theoretical, and computational analyses in supporting on-going or future space physics research efforts;
- Development of the IMAGE mission data system;
- Development and operation of the Coordinated Data Analysis Workshop (CDAW) program, including the CDAWeb system now primarily supporting correlative access and analysis of data from the International Solar-Terrestrial Physics (ISTP) program;
- Development and operation of the Satellite Situation Center (SSC) and associated systems such as SSCWeb;
- System and database administration, maintenance, configuration, and services as appropriate and required;
- Participation in the work of several higher-level programs such as the IACG working groups and the NASA Space Physics Data System (SPDS);
- Responsibilities in assuring archive data quality, generation of select "value-added" data products and archiving of space physics relevant models; and
- Development of radiation belt models and tools for space weather research.

SPDF works closely with Code 600 laboratory and flight project personnel in space physics data operations activities. SPDF develops and implements capabilities to serve space physics scientists' needs by supporting the creation and distribution of multi-source, multi-parameter, and multi-project data sets and databases, "value-added" databases, and other products (e.g., CD-ROMs); develops such systems for specific NASA flight projects; and leads the development of network-accessible advanced database systems in the areas of solar-terrestrial physics. This includes the development, implementation, and operation of the CDAW program. SPDF works closely with flight project personnel in data system planning, utilization, and operation. SPDF designs and implements the SSC software system, which provides mission planning information for scientists involved in the ISTP program, supporting NASA and other agency spacecraft science operations planning. SPDF personnel represent the National Space Science Data Center, as appropriate, in interfacing with data producers to identify and coordinate the acquisition of appropriate space physics data from active or past missions. SPDF identifies and scientifically validates loading of appropriate data to the active online/near-line space physics data archive, and development of appropriate user interface and other tools for that environment. SPDF develops and integrates state-of-the-art capabilities and systems necessary to carry out its mission.

3.1 Science Investigation Data Analyses

The SPDF supports reduction and analyses of archived and current space mission data for various on-going space physics data and research efforts.

The SPDF is involved in the design, development, testing and archiving of the next generation of terrestrial trapped particle radiation environment models, including data organization and analysis necessary to this development. The SPDF leads several science investigations in magnetospheric physics including studies of various magnetospheric boundaries (*e.g.,* bow shock, magnetopause, and cusp) and processes using both current and older data (e.g. cf. http://spdf.gsfc.nasa.gov/geo_wind_bow_shock.html). The SPDF also leads in key studies and research supporting the Radio Plasma Imager (RPI) now being designed for the IMAGE mission and plays a role in the analysis of cosmic ray data from several current missions. Requirements in this area shall include:

67. Collect all data for use in the trapped radiation modeling, provide analysis support and design/develop/test/archive the resulting new trapped radiation models and supporting data;

68. Support data organization and analysis for magnetospheric (including bow-shock and high-latitude) science and other research studies or data efforts; and

69. Support appropriate study definition and analyses for the design and subsequent operation of the RPI on IMAGE.

3.2 IMAGE Mission Data System

The Imager for Magnetopause-to-Aurora Global Exploration or IMAGE is a first MIDEX class mission, selected by NASA in 1996, to study the global response of the magnetosphere to the changes in the solar wind (cf. http://image.gsfc.nasa.gov/). It will utilize neutral atom, ultraviolet, and radio imaging techniques. Major changes occur to the configuration of the magnetosphere from quiet times to disturbed times as a result of changes in and on the sun, which in turn change the solar wind.

The SSDOO is responsible for the development of the IMAGE mission data system. The contractor shall support efforts to develop, test, and implement the IMAGE data system. The IMAGE Mission has a completely open data policy with no periods of proprietary data rights. The IMAGE data system shall be able to process the IMAGE Level 0 data into Level 1 data and a series of browse products, and distribute all IMAGE data. The Level 0 data will be delivered to IMAGE investigators and to the NSSDC for long term archiving and distribution along with a series of browse and other calibrated data products. The NSSDC will immediately place these IMAGE data on-line in the NASA Data Archive and Distribution Service (NDADS) system for rapid access by the space science community.

For this technology and research element the contractor shall:

70. Participate in the development and testing of the IMAGE data processing system utilizing a variety of expert system and Artificial Intelligence technologies.

71. Participate in the development and testing of the IMAGE WEB based data access and display system.

72. Participate in the development and testing of the IMAGE data distribution system.

3.3 Coordinated Data Analysis Program and Workshops

The Coordinated Data Analysis Workshop (CDAW) program is designed to further the conduct and development of working systems and new techniques/tools for large-scale collaborative scientific research, using data from many investigators to address significant global-scale Solar-Terrestrial physics problems that may not otherwise be addressable.

The current coordinated data analysis effort is centered on a primarily Web-based system (CDAWeb) for common and convenient access to combined collection of browse and analysis-quality data from current space physics missions, mostly associated with the International Solar-Terrestrial Physics (ISTP) program. The CDAWeb system is now operational and rapidly growing in community popularity but must continue to evolve in functionality and performance as well as its robustness and efficiency in maintaining the working database (cf. http://spdf.gsfc.nasa.gov/ or http://cdaweb.gsfc.nasa.gov/). CDAWeb is built upon the RSI's Interactive Data Language (IDL) product and is keyed to data formatted in the NSSDC's Common Data Format (CDF) following the ISTP/IACG Implementation Guidelines. CDAWeb supports data from ISTP, the InterAgency Consultative Group (IACG) and other campaign databases and appropriate archival data (*e.g.,* ISIS and DE) products.

Beyond the CDAWeb service and the critically-important underlying database proper, the coordinated data analysis program includes elements of workshops and/or shared workshop support; guidelines, tools (*e.g.,* makeCDF) and direct support for casting data into the underlying common format; and a display and analysis library (CDAWlib) of the routines that enable the CDAWeb service.

In this area, the contractor shall provide the following support:

73. Design, build, operate, document, describe, demonstrate, maintain, monitor (including appropriate usage and performance statistics) and support upgrades (including ports to new hardware) all aspects of the CDAWeb system necessary to continue effective operations and to support campaigns or workshops;

74. Build, maintain and extend the CDAWeb databases necessary to continue effective operations and to support campaigns, workshops, or enhanced science community and public access to archival data;

75. Build, maintain and develop tools and libraries supporting this effort, including further development of data formatting (*e.g.,* makeCDF) and data display (*e.g.,* CDAWlib) tools;

76. Provide logistical support to workshops and related gatherings;

77. Provide specialized and science-expert utilization assistance to users of the CDAWeb system and database, and all related tools and services; and

78. Support the distribution of the software and database as appropriate to ISTP and other NASA-sponsored facilities or other international agencies or facilities.

3.4 Spacecraft Mission Science Planning

The Satellite Situation Center (SSC) is designed to serve the planning needs of investigators for coordination of data acquisition and collaborative efforts. The SSC was

developed to support the International Magnetospheric Study (IMS) by providing information necessary to help achieve acquisition of coordinated data taken by satellite, rocket, balloon, aircraft, and ground-based sensors developed by the international science community. Today, the SSC continues to provide both actual and predictive spacecraft trajectories and information for a wide variety of scientific purposes.

Currently, SPDF and the SSC are playing a major role in an international spacecraft coordination program under the auspices of the IACG, including computation of mutually favored orbits of GEOTAIL, WIND, POLAR, and INTERBALL spacecraft. The primary SSC software and database are now configured to be fully Web-accessible (SSCWeb) and now simultaneously support the operational SSC, needs of the ISTP Science Planning and Operations Facility (SPOF) and the external science community of users (including external campaigns such as those of the International Auroral Study/IAS) (cf. http://sscweb.gsfc.nasa.gov/). SPDF thrusts include continuing functional enhancements to SSCWeb and software maintenance, as well as the continuing population of the underlying ephemeris database using facilities of the GSFC Flight Dynamics group.

In this area, the contractor shall provide the following support:

79. Operate the Satellite Situation Center (SSC) to enable NSSDC to satisfy its WDC-A-R&S responsibilities (i.e., assign spacecraft IDs; issue launch notices and Spacewarn Bulletins, etc.), support IACG and other science planning activities in coordination and cooperation with other groups such as the GGS/ISTP project's SPOF, and to respond to other internal (SSDOO) and external requests for SSC services and products;

80. Design, build, document (including algorithms, references and test suites), describe in User's Guides, maintain, monitor (including appropriate usage and performance statistics) and support upgrades (including ports to new hardware) of all aspects of the SSCWeb system and other related software as necessary to continue effective operations and support campaigns or workshops;

81. Acquire orbit element sets and build, maintain and extend the SSC ephemeris databases (including that of SSCWeb) as necessary to continue effective operations and to support campaigns or workshops;

82. Provide specialized and science-expert utilization assistance to users of the SSCWeb system and database, and all related tools and services; and

83. Support the distribution of the software and database as appropriate to ISTP and other NASA-sponsored facilities or other international agencies or facilities.

3.5 Program and Future Missions Support

SPDF is involved in the work of higher-level programs, including various elements of support for the Inter-Agency Consultative Group (IACG), the NASA Space Physics Data System (SPDS), COSPAR, and NASA Headquarters.

The IACG (cf. http://iacg.org/) and its associated working groups in space sciences are made up of key administrative and scientific personnel in the four major international space agencies: the Space Research Institute of the Academy of Sciences (IKI) of Russia, the Institute of Space and Aeronautical Science (ISAS) of Japan, the National Aeronautics and

Space Administration (NASA) of the United States, and the European Space Agency (ESA). Multi-space agency cooperation in achieving the new science objectives will primarily be in planning science campaigns, of which presently four are defined (cf. the IACG URL above for detailed descriptions), and facilitating subsequent data exchange and coordinated analyses. SPDF directly supports these activities via CDAWeb and SSCWeb, by hosting the IACG WWW home page and various campaign pages, along with special activities for the working groups.

The SPDS is a NASA program to facilitate access and use of space physics data from NASA missions and other data sources relevant to the NASA mission (cf. http://www.spds.nasa.gov/). The SPDS operates as a loose confederation of data service providers and a voluntary Coordination Working Group and Discipline Coordination Teams. SPDF leads SPDS project coordination (including hosting the SPDS home page and several discipline pages, as well as travel support for key meetings and brokering some necessary consultation services), operates a number of direct services to the SPDS community (not only CDAWeb, SSCWeb etc. but hosting the SPDS home pages and some discipline pages) and has developed projects of joint SPDS and NASA Headquarters management interest (*e.g.*, the Space Physics Data Availability Catalog). SPDS support also extends to support and review for some project data management plans and mission science data planning.

In this effort, the contractor shall:

84. Support the efforts of the IACG working groups and campaigns' science analysis activities;

85. Support SPDS project coordination activities;

86. Maintain and upgrade as necessary the Space Physics Data Availability Catalog (both software and database population);

87. Conduct systems engineering studies in and support the development and implementation of space physics data standards; support the applications of data standards guidelines for space physics data;

88. Provide support for the development, review, and execution of Project Data Management Plans and/or participation in the planning and development of science data operations for space science missions and programs.

3.6 Archival Data Quality Assessments, Data Products and Models Support

SPDF leads responsibilities of SSDOO and NSSDC in assuring data quality of processed and archived space physics data products, and defines/leads specific efforts in the generation of select "value-added" data products and appropriate access and archiving of space physics relevant data and models.

Among several key value-added data products are the OMNI and COHO databases; see http://nssdc.gsfc.nasa.gov/omniweb/ and http://nssdc.gsfc.nasa.gov/cohoweb/ for the Web-based interfaces to these databases. The OMNI composite data set is one of the most accessed value-added data sets that the NSSDC maintains. The OMNI field, plasma and energetic particle data are provided by approximately 12 different spacecraft (starting

1963), and extensive cross-calibrations were performed in creating the composite set. In addition, the data set contains selected solar and geomagnetic activity indices (R, C9, Kp, Dst). The COHO database includes fields, plasmas, and energetic particle measurements from heliospheric spacecraft including Pioneer 10/11, Voyager 1/2, Helios, and Pioneer Venus Orbiter. Additional data products of values to the space physics and space weather community are likely to be defined and developed over time. Data product activities may include data formatting and reformatting of data now in or to be ingested into the NSSDC archive.

Models are the synthesis of the accumulated experimental evidence. They allow us to advance from monitoring the environment to forecasting it. A modeler's task is to combine past data records from different experimental techniques and to extract the dominant variation patterns. The SPDF contributes expertise and resources to several aspects of the long-term goal of establishing reliable models for the entire solar-terrestrial environment and making them most widely accessible. It is actively involved in international efforts to validate, update, or improve the existing models and develop new models for regions (*e.g.*, IRI, radiation belts) and parameters not yet described. Several international scientific organizations (*e.g.*, COSPAR, URSI, IAGA) supervise and guide the modeling efforts. The models selected and recommended by these organizations are distributed by the World Data Centers.

In this area, the contractor shall:

89. Perform quality assessments of the NSSDC space physics data and model archives and determine ways to improve the archive usability, documentation, and accessibility;

90. Continue to provide support for the creation and rapid public access (*e.g.*, via OMNIWeb and COHOWeb) of the OMNI and COHO data and any other databases/data products as those are defined; and

91. Acquire, maintain, update, document and provide scientific and technical support to easy access and usability to space physics models as appropriate.

92. Provide scientific guidance to data restoration and preservation activities in the NSSDC and external data providers, as required.

4 Archiving and Information Systems at NSSDC

NSSDC is a multidiscipline archive, supporting astrophysics, solar and space plasma physics, and lunar and planetary science. NSSDC acquires data from spaceflight projects, discipline data systems, and individual principal investigators. NSSDC manages data both in on-line modes and in off-line stores of tapes, film, and other media, and disseminates data worldwide. Major NSSDC activities include:

* Archiving and disseminating scientific data from specific astrophysics and space physics missions.
* Interfacing with other astrophysics, planetary, and space physics discipline data systems.
* Defining, developing, and operating the on-line WWW-accessible Master Directory of all NASA scientific datasets.
* Promoting data system interoperability by working with other data system providers.
* Leading the NASA activity in international standardization efforts for compatibility of distributed on-line scientific data and information files, through NOST.
* Managing the NASA Data Archive and Distribution Service (NDADS).
* Developing Levels of Archive Service to better serve customers.
* Maintaining expertise in advanced information and data storage technologies for distributed and intelligent data systems.

NSSDC works closely with Code 600 laboratory and the external space physics science community. NSSDC serves the science community by recognizing and developing information system standards and interoperability; Developing and enhancing information systems that promote efficient data identification and ordering; Understanding and developing technologies that enhance the accessibility and usability of data (technologies such as database, network, mass storage, etc.); Supporting the acquisition of new and current datasets and dataset descriptions; System engineering NSSDC enhancements; and, Operating NSSDC computers. NSSDC also supports the science community by distributing publications, providing material for educational purposes, and developing electronic handbooks.

This section describes the elements of the archiving and information systems at NSSDC, as well as work done in collaboration with the ADF and SPDF.

4.1 Science Data and Information Systems Standards

The NASA/Science Office of Standards and Technology (NOST; http://bolero.gsfc.nasa.gov/nost) serves the NASA science communities in evolving interoperable data systems by performing a number of functions designed to facilitate the recognition, development, adoption, and use of standards by these communities. The

contractor shall support the NOST effort, which disseminates information about existing and emerging standards and new technologies of relevance to the NASA science community and its related data systems. The contractor shall provide the following support:

93. Support the development of new standards through participation in the international Consultative Committee for Space Data Systems (CCSDS) Panel 2, and the Common Data Format (http://nssdc.gsfc.nasa.gov/cdf/cdf_home.html) development team;

94. Identify relevant standards and maintain expertise in the nature of these standards as they apply to NSSDC operations support;

95. Participate in the appropriate standards development groups and meetings promoting the use of standards in all aspects of NASA data systems;

96. Assist in and continually improve the operation of the NASA/Science Office of Standards and Technology through maintenance of the NOST Standards Library and the Standards and Technology Information System;

97. Maintain the Common Data Format (CDF), and Standard Formatted Data Unit (SFDU) standards;

98. Develop appropriate CDF, and SFDU (and other formats) browsing and validation software capable of execution in a variety of computing environments; and

99. Collaborate and coordinate with other groups to avoid duplication of effort.

4.2 Information (Metadata) Systems Development

The NSSDC data and information systems will continue toward the goal of providing users with a quick and efficient end-to-end process of identifying, understanding, accessing, ordering, and effectively using needed data. The contractor shall provide the following support for data and information systems development:

100. Prepare a requirements analysis for the definition, development, upgrade, and integration of NSSDC information (metadata) systems (NMD, RSIRS, IRAND, NMC, etc.) into an integrated whole. The analysis should address: the needs of external scientists, NASA managers, and NSSDC staffers; hardware platforms and software approaches; user interface techniques; etc.; and

101. Develop an architectural design for an optimally integrated NSSDC information system environment based on the preceding requirements analysis. This design should take into account the latest developments of information system technology, such as database technology, the World Wide Web, digital library applications, standards, etc. Planners are expected to incorporate knowledge of related research and application efforts at NSSDC and elsewhere that might benefit the information system environment.

102. Recommend and pursue approved prototype activities that will help to determine the best approach for the development and implementation of the future generic information system environment; and

103. Provide expertise in the needed software and hardware functionality to support the upgrade of the information (metadata) ingest, retrieval, and dissemination functions.

4.3 Data Systems Evolution

The NSSDC manages a great deal of data, offline in deep archives and as inventories of CD-ROMS, nearline as data files on NDADS, and online both as FTP-accessible files and as files subsettable by time and parameter in systems such as CDAWeb and OMNIWeb. To offer the best services and products to customers, the NSSDC continuously evaluates evolving technologies and methodologies for potential inclusion into the NSSDC operational environment. The purpose of this section of the SOW is to evaluate evolving technologies and methodologies relevant to NSSDC operations, make recommendations regarding future PBC implementations, and implement non-PBC functions as appropriate. Specifically, this effort shall include the following:

104. Prepare a plan for the evolution of NSSDC systems. The system evolution plan should take into account the latest developments in information system technology, including mass storage device technology, World Wide Web technology, and other key information system technologies. The plan should focus on strategies that allow the NSSDC to maintain leading-edge competencies and capabilities while satisfying customer requirements.

105. Define and implement paradigms replacing the present project-datatype-eid paradigm, and ensure the proper links between the new user-accessible search terms and the bitfile ID's that are the main ID at the PBC bitfile management level.

106. Reserved.

107. Reserved.

108. Reserved.

109. Reserved.

110. Reserved.

111. Reserved.

112. Reserved.

4.4 Data Acquisition and Scientific User Support

The data and information archive of the NSSDC shall continually be acquired, enhanced, accessible, and maintained. The NSSDC archive supports archival research, and allows requesters the opportunity to browse various aspects of the archive. It is important to note that NSSDC teams with the ADF and the SPDF to accomplish many of the data and information archive acquisition and management functions (also see discussion of acquisition responsibilities in the Acquisition Scientist Handbook, at http://nssdc.gsfc.nasa.gov/~bell/acquisition/). In this area, the contractor shall support the following functions:

113. Maintain current knowledge of the status of all NASA space science missions.

114. Act as an interface with data providers and data users to define, direct and participate as necessary in implementation of the acquisition of data and metadata into and within the NSSDC archive and the appropriate level of NSSDC support and services for all such data and metadata

115. Generate and maintain current descriptions of missions, instruments, and planned or publicly available data products. Some such descriptions should be designed to serve the research community, others to serve the general public, educators, and students;

116. Help projects develop Project Data Management Plans (PDMPs) and design data products; provide advice on relevant standards, and data handling techniques;

117. Support all aspects of data dissemination, including development of access requirements, CD-ROM development and production, appropriate announcements of data availability, meeting presentations and demonstrations, offline request processing, etc., and provide proprietary data dissemination capability;

118. Make the archive metadata available on the World Wide Web with links to related Web pages, data kept online or near-line, and data-ordering forms, as appropriate;

119. Provide appropriate support for Guest Investigators: assist in the development of data browsing and analysis software and related documentation, serve as point of contact for information about usage of mission data, provide user support by e-mail and phone;

120. Develop user interfaces to the mission data products that enable expeditious location and delivery of the relevant data to the research community and provide appropriate data browsing capabilities; and

121. Provide for a process that will implement ways to use state-of-the-art technology to improve the flow of data from the data producer to the archive.

4.5 Computer Systems and Network Management

The SSDOO utilizes a number of government-owned super-mini, mini, micro and desktop computers for performing all the major functions of the organization. These computers have a variety of operating systems such as VMS, UNIX, Microsoft Windows, and Macintosh. For effective use, nearly all of these computers are network connected using one or more of FDDI, Ethernet, wide-area (DECnet and TCP/IP), and Appletalk. Configuration management and traffic and load balancing are required on these computers. Performance and utilization of computer resources shall be optimized. Computer operators are required to support manual loading and manipulation of data and information in a normal computer room environment. The computers managed and operated under this part of this contract are listed in Schedule B. The contractor shall:

122. Provide systems management support for government-owned SSDOO computers identified in Schedule B;

123. Perform configuration management, traffic and load balancing on government-owned SSDOO computers identified in Schedule B and networks as required;

124. Maintain all the existing system-level software to currently approved revision levels without adversely affecting operations;

125. Maintain a systems environment that maximizes systems availability;
126. Provide a level of computer systems security that protects government computers and resources from computer hackers, viruses, worms, Trojan horses, etc.;
127. Perform regular system and magnetic disk backup with remote storage of the backup;
128. Optimize performance and utilization of these computer systems;
129. Provide computer operations support; and
130. Manage computer output media.

4.6 Reserved

4.7 Education Activities

The SSDOO is a major participant in the Sun-Earth Connection Education Forum (SECEF) which is operated as a partnership between GSFC and the University of California, Berkeley. In particular, the SSDOO supports GSFC's lead role in Science Results Capture and archiving for education and outreach.

The SSDOO also maintains an Education Committee with contractor and civil servant participation. This committee coordinates all SSDOO K-12 and higher education activities. The Chairperson of the SSDOO education committee is a civil servant and a member of the Space Sciences Directorate Education Committee. In these areas, the contractor shall:

133. Assist in the operation of the SECEF by: coordinating with Sun-Earth Connection missions to capture their science results; cataloging and archiving useful SEC products; creating new products and programs where needed; and helping publicize the SECEF.
134. Update and maintain the SSDOO Educational home page;
135. Participate in mentoring summer students in programs such as the Summer High School Apprentice Research Training Program (SHARP); and

4.8 Electronic Handbooks

Electronic Handbooks are discussed in Section 1.7 of this SOW. Under the LOE part of this contract, the contractor shall support:

136. Support the specification of requirements for and intellectual contents of individual Electronic Handbooks as requested.
137. Support the application and use of the handbooks once created.

5 Support for Orbiting Satellites Project

As part of the SSDOO, the Orbiting Satellites Project (OSP) (<http://www.gsfc.nasa.gov/c630_1/>) was established to manage and administer the Mission Operations and Data Analysis (MO&DA) phase of GSFC operating satellites in the astrophysics and space physics disciplines. The Orbiting Satellites Project provides project management and technical direction for the control of selected operating satellites. OSP responsibility includes overall business and technical management of orbital operations, contract maintenance and closeout, scientific and technological experimentations, data processing and dissemination, project-wide planning and evaluation, monitoring and analyzing the status of spacecraft and experiment hardware, maintaining liaison with the data user community, and developing alternate modes of operation to maximize the scientific return of the mission. Currently, OSP manages the Compton Gamma Ray Observatory (CGRO), Interplanetary Monitoring Platform (IMP-8), Solar, Anomalous and Magnetospheric Particle Explorer (SAMPEX), the International Solar Terrestrial Physics (ISTP) Program (which includes Wind, Polar, and the NASA responsibilities on the Geotail, Cluster, and SOHO missions), the X-ray Timing Explorer (XTE), and the Fast Auroral Snapshot Explorer (FAST) satellite. Future OSP missions will include IMAGE and the Submillimeter Wave Astronomy Satellite (SWAS).

5.1 OSP System Engineering

OSP activity is largely carried out by SSDOO and other GSFC civil servants, however, system engineering support is occasionally needed. The system engineering support required is related to the technical management of OSP satellite orbital operations, data processing and dissemination, project-wide planning and evaluation, acting as liaison between the OSP and the data user community, and proposing alternate modes of operation to maximize the scientific return of the mission while reducing costs. Currently, this activity is supporting ongoing reengineering and automation efforts to reduce mission operations costs for the ISTP missions.

138. The contractor shall provide system engineering support to the OSP in the SSDOO.

6 Year 2000 Compliance

Milestones for Renovation, Validation and Implementation: Any IT determined to be non-Year 2000 compliant shall be replaced, retired, or repaired in accordance with the following schedule:

139 "Renovation" includes making and documenting software and hardware changes, developing replacement systems, and decommissioning systems to be retired. The Contractor must complete renovation of affected software, hardware, and firmware by September 30, 1998.

140 "Validation" includes unit, integration, system, and end-to-end testing for Year 2000 compliance. The Contractor must complete validation and testing of converted or replaced systems by January 31, 1999.

141 "Implementation" includes acceptance testing and integration of converted and replaced systems into a production environment. The Contractor must complete implementation by March 31, 1999.

At a minimum, the Contractor shall provide documentation, including project plans and status reports, which demonstrate that the Contractor is meeting the milestones listed above.

Acronyms

AAS	American Astronomical Society
ADC	Astronomical Data Center
ADF	Astrophysics Data Facility
AIAA	American Institute for Aeronautics and Astronautics
AIM	Automated Internal Management File
AIPS	Astronomical Image Processing System
AMASE	Astrophysics Multi-Spectral Archive Search Engine
ANSI	American National Standards Institute
ARMS	Automated Retrieval Mail System
ASCA	Advanced Satellite for Cosmology and Astrophysics
CCB	Configuration Control Board
CCSDS	Consultative Committee for Space Data Systems
CDAW	Coordinated Data Analysis Workshop
CDAWeb	Coordinated Data Analysis [Workshop] Web
CDF	Common Data Format
CDHF	Central Data Handling Facility
CD-ROM	Compact Disc-Read Only Memory
CDS	Centre de Donnees de Strasbourg
CNES	Centre Nationale díEtudes Spatiales
COBE	Cosmic Background Explorer
COHO	Coordinated Heliospheric Observation
COSPAR	Committee on Space Research
CRUSO	Coordinated Request and User Support Office
DCE	Desktop Computing Environment
DE	Dynamics Explorer
DEC	Digital Equipment Corporation
DECnet	DEC Networking Products (generic family name)
DIF	Directory Interchange Format
DLT	Digital Linear Tape
EOS	Earth Observing System
EOSDIS	EOS Data and Information System
ESA	European Space Agency
ESDIS	Earth Science Data & Information System
FITS	Flexible Image Transport System
FTP	File Transfer Protocol
GCMD	Global Change Master Directory
GOF	Guest Observer Facility

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GSFC	Goddard Space Flight Center
HEAO	High Energy Astrophysics Observatory
HEASARC	High Energy Astrophysics Science Archive Research Center
HQ	Headquarters
HST	Hubble Space Telescope
IACG	Inter-Agency Consultative Group
IAU	International Astronomical Union
IDA	Interactive Digital Archive
IDN	International Directory Network
IKI	Space Research Institute (Institut Kosmicheskich Issledovanyi, Moscow)
IMAGE	Imager for Magnetopause to Aurora Global Exploration
IMP	Interplanetary Monitoring Platform
IMS	International Magnetospheric Study
IRAND	Interactive Request Activity and Name Directory
IRAF	Image Reduction and Analysis Facility
IRAS	Infrared Astronomical Satellite (The Netherlands-NASA-U.K.)
ISAS	Institute of Space and Astronautical Science (Japan)
ISIS	International Satellites for Ionosphere Studies
ISEE	International Sun-Earth Explorer
ISO	International Standards Organization
ISTP	International Solar-Terrestrial Physics
IUE	International Ultraviolet Explorer
JICST	Japan Information Center for Science and Technology
JIMS	Jukebox interface Management System
JPL	Jet Propulsion Laboratory (NASA)
LOE	Level of Effort
MDSS	Mission Data Staging System
MO&DA	Mission Operations & Data Analysis
MPI	Max Planck Institute
MURED	Minority Universities Research and Education Division
NARA	National Archives and Records Administration
NASA	National Aeronautics and Space Administration
NASIRC	NASA Automated Systems Incident Response Capability
NBS	National Bureau of Standards (now NIST)
NDADS	NASA Data Archive and Distribution System
NIST	National Institute of Standards and Technology
NMC	NSSDC Master Catalog
NMD	NASA Master Directory

NODIS	NSSDC On-Line Data and Information Services
NOST	NASA/Science Office of Standards and Technology
NSDF	NSSDC Supplemental Data File
NSSDC	National Space Science Data Center
OMNI	Interplanetary Medium Data (not an acronym)
OODB	Object Oriented Database
OSP	Orbiting Satellites Project
OSS	Office of Space Science
PBC	Performance-based Contract
PDMP	Project Data Management Plan
PIMS	Personnel Information Management System
RAND	Request Activity and Name Directory
REQ	NSSDC Data Request Service
ROSAT	Roentgen Satellite (German X-ray research satellite)
RPI	Radio Plasma Imager (on IMAGE)
RSDP	ROSAT Science Data Processing
RSIRS	Relational System for Information Retrieval and Storage
RXTE	Rossi X-ray Timing Explorer
SBIR	Small Business Innovative Research
SEC	Sun Earth Connections
SECEF	Sun Earth Connections Education Forum
SFDU	Standard Formatted Data Unit
SHARP	Summer High School Apprentice Research Training Program
SIR	Shuttle Imaging Radar
SOAR	Software for Optical Archiving and Retrieval
SOP	Standard Operating Procedure
SPACEWARN	World Warning Agency for Satellites
SPDF	Space Physics Data Facility
SPDS	Space Physics Data System
SQL	Standard Query Language
SSC	Satellite Situation Center
SSDS	Space Science Data System
SSDOO	Space Science Data Operations Office
STELAR	Study of Electronic Literature for Astronomical Research
STIS	Standards and Technology Information System
STScI	Space Telescope Science Institute
TRF	Technical Reference File
2MASS	Two Micron All Sky Survey

USRSDC   U.S. ROSAT Science Data Center

WDC-A-R&S   World Data Center A for Rockets and Satellites
WORM   Write-Once, Read-Many
WWW   World Wide Web

Schedule A

Computer Hardware and Software Lists and Definition of Availability for Performance Based Part of Contract

The computers and their hardware configurations covered in the performance based part of the contract are shown in Table A1. The system level software running on these computers is shown in Table A2. Keeping these computers operational or available to perform is one of the metrics for measuring contractor performance. For this contract, this metric is defined as:

$$\text{Availability (\%)} = \frac{100}{\sum_{g=1}^{n} W_g} \sum_{f=1}^{n} \frac{W_f \bullet (t_T - t_D)_f}{(t_T)_f}$$

Where
- n = number of components
- W_f, W_g = weight factor for each component
- t_T = time in reporting period minus scheduled downtime for each component
- t_D = unscheduled downtime for each component

The weights, W, are provided in Table A1 for each component. The above equation allows for the addition/deletion of components over time, in which case the total of the weights would not necessarily add to 100.

Example Calculation

First of all note from Table A1 that $\sum_{g=1}^{n} W_g = 100$. Therefore, availability "A" becomes

$$A = \sum_{f=1}^{n} \frac{W_f \bullet (t_T - t_D)}{(t_T)_f}$$

Now consider a one month period (or 30 days) for which availability is to be determined. Therefore, $t_T = 30$ - component scheduled downtime.

Assumptions for the period are:
1. DEC TL822 DLT jukebox on NDADSA down for 2 days
2. NDADSC scheduled down for 1 day for new software installation
3. One of the 8 Andataco 9 GB disk drives on NDADSC failed and had to be returned to the factory for repairs, resulting in its being out-of-service for 14 days

Thus the availabilities for the systems are:

$$A_{NDADSA} = 2\frac{(30-0)}{30} + 6\frac{(30-2)}{30} + 2\frac{(30-0)}{30} \qquad = \quad 9.6$$

$$A_{NDADSB} = 10\frac{(30-0)}{30} \qquad = \quad 10$$

$$A_{NDADSC} = 0.25\frac{(29-14)}{29} + 14.75\frac{(29-0)}{29} \qquad = \quad 14.88$$

$$A_{NDADSD} = 15\frac{(30-0)}{30} \qquad = \quad 15$$

$$A_{NDADSE} = 15\frac{(30-0)}{30} \qquad = \quad 15$$

$$A_{NDADSF} = 15\frac{(30-0)}{30} \qquad = \quad 15$$

$$A_{NCFMRB} = 15\frac{(30-0)}{30} \qquad = \quad 15$$

$$A_{NCFMRS} = 2\frac{(30-0)}{30} \qquad = \quad 2$$

$$A_{NCFMR} = 1\frac{(30-0)}{30} \qquad = \quad 1$$

$$A_{NCFVCS} = 2\frac{(30-0)}{30} \qquad = \quad 2$$

Thus total availability (%) is $\qquad = \quad 99.48$

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**Table A1 (9/21/2000)
Computer Hardware List for
Performance Based Part of Contract**

Availability
<u>Weights</u>

BORNEO - DEC 3000/600 Workstation, Serial # NI44500RP1   1
          256 MB Memory
      Peripherals: DEC CD-ROM
             1 – DEC RZ26 1 GB Disk Drive
             1 – Conner 4 GB Disk Drive
             1 – Python 28388 4 mm Tape Drive
             1 – DEC TZ88 DLT Tape Drive   —

                                                  1

NDADSA - Alpha 1000A, Serial # N1623031H5   5
          256 MB Memory
      Peripherals: DEC CD-ROM
             DEC TL822 DLT Jukebox   5
             8 – Andataco 9 GB Disk Drives   0.25 ea = 2
             2 – DEC RZ28 2 GB Disk Drives   0.5 ea = 1
             2 – DEC RZ29 4 GB Disk Drives   0.5 ea =<u> 1 </u>

                                                  14

NDADSB - Alpha 1000A, Serial # NI62202D7N   4
          256 MB Memory
      Peripherals: DEC CD-ROM
             Falcon #5-4/9000B-WDE4 4X9 GB Disk Tower   2
             1 – DirectTech 15150-1 4 GB Disk Drive   1
             1 – Seagate ST410800N 9 GB Disk Drive   1
             1 – Sylvest SY/T1400ES-DEC 8 mm Tape Drives 1
             1 – Andataco DLT Tape Drive   2
             3 – DEC RZ28 2 GB Disk Drives   1 ea =<u> 3 </u>

                                                  14

NCFMRS - VAXStation 4000, Serial # AB31502XCV   1
        16 MB Memory
     Peripherals: 1 – Seagate ST41200N 2 GB Disk Drive
                 1 – Kennedy 9914D 9-Track Tape Drive
                 1 – Kennedy 9100 7-Track Tape Drive
                 1 – Kennedy 9219 Formatter
                 1 – Winchester FLASHDAT 8 mm Tape Drive   ___

                                                        1

NCFMR - MicroVAX II, Serial # WF90311629   1
        13 MB Memory
     Peripherals: 1 – Optimum 1000M Optical Disk Drive
                 1 – Alphatronix INSPIRE Optical Disk Drive   ___

                                                          1

NCFVCS - MicroVAX 3400, Serial # WF01535182   0
        12 MB Memory
     Peripherals: 3 – DEC RF30 Disk Drives   ___

                                                         0

Rotary Power & Distribution Modules, Serial # 1053-01&1273   1
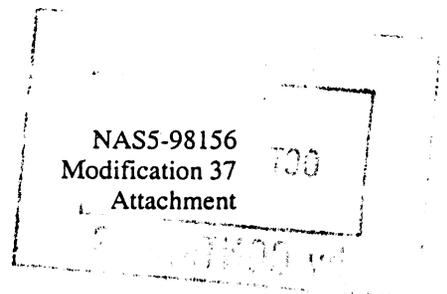
Table A2

Computer System Software Matrix
(Software Version Numbers as of June 1998 are Listed in Matrix)

SOFTWARE	TYPE *	NDADSA	NDADSB	NDADSC	NDADSD	NDADSE	NDADSF	NCFMRB	NCFMRS	NCFMR	NCFVCS
BOOKBROWSER	Vendor +	4.2	4.2	4.2	4.2			4.2	4.2	4.2	
C	Vendor +	5.6	5.6	5.6	5.6			5.6	5.6	5.6	5.6
DECPS-DC (Polycenter)	Vendor –	2.2	2.2	2.2	2.2						
DECPS-PA (Polycenter)	Vendor –			2.2							
DECSET	Vendor +		12.2		12.2						
DVNETRTG (VAX DECNET)	Vendor –				6.2				6.2	6.2	6.2
DW-MOTIF	Vendor +	1.2.4	1.2.4	1.2.4	1.2.4			1.2.4	1.2.4	1.2.4	
FORTRAN	Vendor +	7.1	7.1	7.1	6.5			7.1	6.5	6.5	
LTM	Vendor –				1.2						
NET-APP-SUP-200	Vendor +	6.2	6.2	6.2				6.2			
OPENVMS-ALPHA	Vendor +	6.2-1H3	6.2-1H3	6.2-1H3			6.2-1H3	6.2-1H3			
OPENVMS-ALPHA-ADL (Number of users)	Vendor +	96	96	96				96	10 (VMS)	8 (VMS)	
OPENVMS-VAX	Vendor +				6.2-1H3				6.2-1H3	6.2-1H3	6.1
PASCAL	Vendor –				4.3						
RBMS	Vendor –				4.3						
SLS-MGR	Vendor +	2.9									
SOLARIS	Vendor +					2.6					
TSM (Terminal Server Manager)	Vendor +		2.1		2.1						
VAX Console System	Vendor –										1.3
VAXCLUSTER	Vendor +				6.2						

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VMSCLUSTER	Vendor +	6.2-1H3	6.2-1H3	6.2-1H3			6.2-1H3	6.2-1H3			
VOLSHAD	Vendor +	6.2-1H3	6.2-1H3	6.2-1H3	6.2		6.2-1H3	6.2-1H3			
VPA	Vendor –				2.2						
IDL	3rd party +	5	5	5	4		5				
MULTINET (TGV)	3rd party +	4.1 A	4.1 A	4.1 A	4.1 A		4.1 A	4.1 A	4.1 A	4.1 A	4.1 A
SQL*Net (Oracle)	3rd party +		2				2				
Sybase Open Client / C Interface (unlimited users)	3rd party +			10.0.4	10.0.4						
SYBASE-SERVER	3rd party +			10.0.2							
TEMPLATE	3rd party –				6.1						
UNITREE (5 TB license)	3rd party +					1.9					
COMPRESS	Freeware	X		X	X						
EMACS	Freeware	X		X	X						
FINGER	Freeware	X		X	X						
FTOOLS	Freeware				X						
GAWK	Freeware				X						
GNU EMACS	Freeware								X		
GREP	Freeware				X						
GZIP	Freeware	X		X	X						
KERMIT	Freeware	X		X	X				X		
LASERWARE-12	Freeware				X						
LYNX	Freeware	X		X	X			X			
MAKE	Freeware				X						
MOSAIC	Freeware	X 2.7-5	X 2.7-5	X 2.7-5	X 2.7-5			X 2.7-5			
NETSCAPE	Freeware							3.04			
PERL	Freeware	X		X	X						
RCS	Freeware	X		X	X						
RLOG	Freeware	X		X	X						
SPELL	Freeware				X						
SWIM	Freeware	X			X						
SWING	Freeware	X		X	X				X		
TAR/VMSTAR	Freeware	X	X	X	X			X	X		
UUDECODE	Freeware								X		
UUENCODE	Freeware								X		

XV	Freeware								X		
ARMS (DCL)	In-house			X							
FST (C)	In-house			X							
JIMS (C and DEC Assembly)	In-house –			X							
SOAR (C and DEC Assembly)	In-house –			X							

* TYPE "Vendor" refers to computer hardware vendor.

\+ Software maintenance contract in place.

– No software upgrade required.

Schedule B

Schedule B. Computer List for
Level of Effort Part of Contract

ADC   -   DEC3000-300X, Serial # AY5180591S
   Peripherals: DEC 4 mm Tape Drive
                   Toshiba XM-3301TA CDROM Drive
                   Seagate ST1917IN 9 GB Disk Drive
                   2 each Micropolis 1991 9 GB Disk Drives
                   Exabyte 8505 8 mm Tape Drive

BOLERO   -   DEC3000-400, Serial # AB33500X9V
   Peripherals: Seagate ST 1917W 4x9 GB Disk Tower

GLISSANDO   -   SGI INDIG02, Serial # O80069088470
   Peripherals: Hewlett Packard Optical 40 GB Jukebox
                   2 each Micropolis 1991 9 GB Disk Drives
                   DLT Tape Cassette Drive

HERMNN -   VAXStation 3200, Serial # WF6411420
   Peripherals: Disk Tower
                   2 each Winchester 4 mm Tape Drives

LANDSHARK   -   SUN Sparc IPC 4/40, Serial # 245M3818
   Peripherals: 2 each APS 4 GB Disk Towers
                   Hitachi CDROM Drive

NCGL   -   SUN Sparc 330 547, Serial # O6206
   Peripherals: SUN CDROM Drive
                   Trimarchi 500 MB Disk Drive
                   SUN 1 GB Disk Drive

NECSYS   -   SGI Challenge DM, Serial # S39859
   Periperals: SGI CD-ROM
                   Seagate ST410800W 7x9 GB Disk Tower
                   2 each Micropolis 1991 9 GB Disk Drives
                   Seagate ST410800N Disk Drive
                   IBM DFHSSZE Disk Drive
                   SGI 4 mm Tape Drive
                   SGI 8 mm Tape Drive

NSSDC   -   DEC3000-600, Serial # AB41400BQN
   Periperals: Seagate ST410800W 4x9 GB Disk Tower

DEC 8505 8 mm Tape Drive
3 each Micropolis 1991 9 GB Disk Drives

RINGS   -   SUN Sparc Ultra 1, Serial # 617F0BCB
  Peripherals: 4 mm Tape Drive
                    SUN 2x4 GB Disk Tower
                    SUN 9 GB Disk Drive

ROSETTE   -   Alpha Station 500/333, Serial # NI63602K4X
  Peripherals: 2 each DEC RZ29B 4 GB Disk Drives
                    Micropolis 1991 9 GB Disk Drive
                    DEC TLZ09 4 mm Tape Drive

RUMBA   -   DEC 4100 5/466, Serial # NI72406555
  Peripherals: DEC 4 GB Disk Drive
                    6 each DEC 9 GB Disk Drives
                    Seagate 8x9 GB Disk Tower

SEASIDE   -   DTK Station
  Peripherals: None

SSCDEV1   -   SUN Sparc 1+, Serial # 028F0294
  Peripherals: 3 each SUN 1 GB Disk Drives

SSCOP1   -   SUN Sparc, Serial # 03KO298
  Peripherals: SUN Disk Drive

TARANTELLA   -   SGI INDIGO, Serial # 08006908A254
  Peripherals: Micropolis 1991 9 GB Disk Drive

VOY386   -   SUN Sparc II, Serial # 204F0240
  Peripherals: 2 each Seagate 2 GB Disk Drives

VOYCRS   -   SUN Sparc, Serial # 324F0305
  Peripherals: 2 each SUN 4x1 GB Disk Towers
                  SUN 2x1 GB Disk Tower
                  ADS 4x4 GB Disk Tower
                  Exabyte 8505 8 mm Tape Drive

Old_VOYPIO -   SUN Sparc 1+, Serial # 017F1349
  Peripherals: INMAC 2x1 GB Disk Tower

New_VOYPIO -   SUN 1 PC, Serial # Z40M1304

Peripherals: SUN 500 MB Disk Drive

XFILES   -.   DEC3000-600, Serial # NI45100PSK
  Peripherals: Quantum 4700 DLT Stacker
                    DEC TKZ09 8 mm Tape Drive
                    DEC 9 GB Disk Drive
                    Micropolis 1991 9 GB Disk Drive
                    Magneto Optical Jukebox

ASCA
Sun Sparc10 Model 40 -- Archive server and peripherals
Sun Sparc10 Model 50 -- Distribution server and peripherals
Sun Sparc20 Model 602 -- Processing and Database server and peripherals
Sun Sparc20 Model 602 -- Processing server and peripherals
Sun Ultra 1 Model 170 -- Processing server and peripherals
Sun Ultra 2 Model 2168 -- Processing server and peripherals

Rosat
DEC VAX 6440 -- Processing and Archive server, peripherals (being phased out)
DEC Alpha 2100 -- Processing server and peripherals
DEC MicroVAX 5000 -- Distribution server and peripherals (being phased out)
DEC Alpha 1000 -- Distribution and Archive server and peripherals

Both ASCA and Rosat
Sun Sparc1+ Model 4/65 -- Web server and peripherals

In addition to the above systems, support is initially required for approximately the following number of government-owned desktop systems (which do not include any contractor-supplied equipment). The contractor is responsible for independently maintaining contractor-supplied desktop systems.

Desktops	Approximate Number
MacOS	94
MS Windows	56
X-terminals	56
Unix	36